

REMARKS

Claims 1-9 remain in this application. Claims 1, 3 and 5 have been amended. It is believed that the Amendments to claims 1 and 5 do not raise new issues which would cause the Examiner to conduct further search. Accordingly, Applicant respectfully requests that the amended claims 1 and 5 be entered.

Formal drawings incorporating the changes made to Figs. 1 and 2 in a Request for Approval of Drawing Changes filed November 18, 2002 are submitted herewith as required by the Examiner.

The drawings are objected to because reference character "5" has been used to designate both a transducer and a coupler. Similarly, the Specification is objected to for referring to both a transducer and a coupler as reference number 5. In the Amendment filed in response to the Office Action dated July 18, 2002, the Specification had been amended to read "a measurement transducer or coupler 5". It should be noted that there is no article in front of the word "coupler" and, accordingly, "a measurement transducer or coupler 5," refers to only one element. As such, reference character "5" is not being used to designate two elements. Regardless, the Specification has been amended to delete the term "transducer" with respect to reference character 5, to expedite prosecution.

Claims 1, 2, 5, 6 and 9 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Kaede et al. Applicant respectfully traverses this rejection because the cited reference does not disclose or suggest the features for compensating for signal changes of an optical wavelength-division multiplex signal caused by cross phase modulation in a fiber amplifier. The reference also does not disclose or suggest generating a control signal from the optical wavelength-division multiplex signal for controlling a phase modulator, as in the present invention.

The present invention is directed to a method and arrangement for reducing the effects of cross phase modulation of multiplex signal induced by a fiber amplifier, and includes generating a control signal from the optical wavelength-division multiplex signal to control a phase modulator, which is inserted in the signal fiber. A multiplex signal is composed of many single signals each of which are responsible for cross phase modulation of other single signals. By generating a control signal from the multiplex signal itself, cross phase modulation can be reduced for all single signals at the same time.

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Control
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The Kaeda et al. reference teaches compensating for wavelength dispersion of an individual signal. The reference teaches that even when a multiplex signal is transmitted, pre-equalization is performed for each signal separately (see col. 4, lines 45-49 and Fig. 14 and its corresponding descriptions). The Kaeda et al. reference, however, does not teach or suggest, or even contemplate, cross phase compensating a multiplex signal by controlling the phase modulator by a control signal generated from the multiplex signal itself, as in the present invention. The purpose of the Kaeda et al. reference, namely dispersion compensation, which is accomplished by modulating the light frequency (carrier) by the associated data signal is entirely different from the problem and solution of the present invention. For these reasons, claims 1 and 5 and their dependent claims 2-4 and 6-9 are allowable over Kaeda et al.

With respect to claim 5, the Office Action states that the Kaeda et al. reference teaches a measurement coupler which couples out part of a WDM signal. However, as shown in Fig. 14, the reference clearly teaches that dispersion pre-equalization circuits are each separately used for correcting only one signal from among many in the WDM signal, but does not disclose or suggest coupling out a part of the entire WDM signal, as in the present invention.

In Kaeda et al., a signal is pre-chirped with its own data sequence. More specifically, the Kaeda et al. reference teaches a method of pre-chirping data, in which impulses are used to compensate the dispersion effect. As is known in the art, dispersion results in a broader impulse at the receiving end. For XPM, only the edges of the pulses of the disturbing signal are relevant. A walk-off between a disturbed signal and a disturbing signal broadens the disturb time of each disturbed signal over the whole of the fiber and leads to a less disturbing effect. The method of pre-chirping disclosed in Kaeda et al., however, is not the same as actively compensating the phase of the disturbed signal by a phase modulator. The present invention is used to compensate the XPM induced by a fiber amplifier. As such, there is no walk-off at all between the single signals of the multiplex signal. The phase modulator is always adjacent the amplifier.

Saunders et al., on the other hand, teaches a method of XPM compensation, which is entirely different from the method of Kaeda et al. In Saunders et al., the disturbed signal is modulated by the envelope of a disturbing signal. This method is applied to compensate the XPM induced in the fiber NZ-DSF. The effect of XPM is measured at the receiving end at the fiber DCF. There are two ancillary effects relevant for compensation. The walk-off, as a side

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effect, reduces the XPM while the signals travel along a fiber having dispersion, and the phase modulation as applied tends to compensate the XPM in the phase modulator. Therefore, the walk-off which reduces the XPM, makes the compensation through a phase modulator more difficult because the compensating signal has also a walk-off against the disturbing signal and the disturbed signal. Accordingly, in contrast to the assertion in the Office Action, the Saunders et al. reference does not provide support that phase modulation and walk-off in the Kaeda et al. reference inherently filters XPM.

More
difficult

In addition, expanding the teachings of Saunders et al. in such a way to compensate a multiplex signal tends to become extremely expensive, for the following reasons. The multiplex signal must be demultiplexed into single signals. For each single signal a separate phase modulator would be necessary, and each phase modulator would be controlled by all other single signals which are used as control signals, and for each separate phase modulator, a separate combiner for all compensating signals would be required to form a compensation signal, and another combiner would be required for multiplexing the single signals to form a compensated multiplex signal, which would add attenuation and additional linearity problems.

cost

As discussed above, the present invention is directed to XPM compensation of a multiplex signal induced by a fiber amplifier. In contrast to the cited references, the present invention uses the complete multiplex signal as a control signal, and only one phase modulator for compensating the complete multiplex signal. These features are not disclosed or suggested in the cited references.

Claims 3, 4 and 7 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kaede et al. Applicant respectfully traverses this rejection for the reasons given with respect to claims 1 and 5, from which claims 3, 4 and 7 depend, and because of the additional features recited in these dependent claims.

Claim 8 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Kaede et al. in view of Becker et al. Applicant respectfully traverses this rejection for the reasons given with respect to claim 5, from which claim 8 depends, and because of the additional features recited in claim 8.

In light of the above, Applicants respectfully submit that independent claims 1 and 5, as well as claims 2-4 and 6-9 which depend therefrom, are both not anticipated and non-obvious

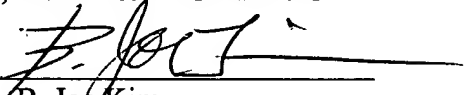
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over the art of record. Accordingly, Applicants respectfully request that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

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